

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
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In the matter of)
)
Amendment of Parts 2 and 15 of the) ET Docket No. 96-8
Commission's Rules Regarding Spread) RM-8345, 8608, 8609
Spectrum Transmitters)

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To: The Commission

REPLY COMMENTS OF METRICOM, INC.

Metricom, Inc. ("Metricom"), pursuant to Section 1.415(c) of the Commission's rules, by its attorneys, hereby submits these Reply Comments in response to the comments filed concerning the Commission's Notice of Proposed Rule Making (the "NPRM") in the above-referenced matter.

I. METRICOM AGREES WITH THE MAJORITY OF COMMENTERS WHO FAVOR THE USE OF DIRECTIONAL ANTENNAS WITH GAINS GREATER THAN 6 DB IN THE 2400-2483.5 MHz BAND.

1. In the NPRM, the Commission expressed its disinclination to relax the 6 dB limit on directional antenna gain for the 2450 MHz band; at the same time, however, it requested comment on whether it should eliminate that limit.^{1/} The majority of commenters who addressed the issue favored the removal of *all* limits on the use of high-gain, directional antennas.^{2/}

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^{1/} NPRM at ¶ 11.

^{2/} See Comments of AT&T, Gabriel, OCOM, Rural Cellular, U.S. Cellular, Cylink, MCT, Part 15 Coalition, and WMC.

2. Cushcraft, in opposing the removal of the 6 dB gain limit in the 2450 MHz band, expresses the concern that "high-gain, fixed, point-to-point antennas would cause too much interference to the proliferation of systems employing lower gain antennas, such as WLANs."^{3/}

3. Such interference concerns are misplaced, and in any event, are purely speculative. In fact, it is more likely for low-power, wide-beam transmissions to interfere with highly directional point-to-point links, through an increase in baseline noise level, than vice-versa. A point-to-point transmission can only interfere with a wireless LAN signal if the fixed beam crosses the path between wireless LAN nodes. Because high-gain antennas produce a tightly-focussed beam, the likelihood of that beam crossing a critical wireless LAN path actually *decreases* with the gain of the antenna. Moreover, as several parties point out, the normal placement of fixed, point-to-point antennas at high points with good line of sight characteristics tends naturally to limit interference with most transmitters.^{4/}

4. Wireless LANs are designed and laid out with redundancy in mind. Generally, a mobile unit can transmit to any one of several fixed units; the fixed units are placed at grid points with multiple transmission paths. This built-in redundancy, in addition to the interference avoidance made possible through the use of spread-spectrum technology, makes wireless LANs highly resistant to interference from spot beam signals. Engineering

^{3/} Cushcraft Comments at 3. *See also* Rockwell Comments at 3 ("[t]he projected wide proliferation of wireless LAN systems in the 2450 ISM band could also be adversely affected by the deployment of high gain antennas").

^{4/} *See* Cylink Comments at 8; MCT Comments at 2-3.

calculations submitted with comments confirm Metricom's conclusion that fears of point-to-point transmissions interfering with wireless LAN operations are groundless.^{5/}

5. The Commission must recognize that the comments of those having actual, real-world experience with directional antennas are particularly relevant. For example, Cylink confirms Metricom's statement that there have been no reported cases of interference from point-to-point links in the 2450 MHz band, even when those links have been operated at gains much greater than 6 dB pursuant to rule waivers granted by the Commission. Accordingly, the Commission should not limit directional antenna gain for 2450 MHz operations.^{6/}

II. IF THE COMMISSION PERMITS FREQUENCY-HOPPING DEVICES IN THE 902-928 MHz BAND TO OPERATE ON FEWER THAN 50 CHANNELS, IT SHOULD RESTRICT THOSE DEVICES TO A TRANSMITTER POWER OF 250 mW.

6. All of the commenters who address the issue agree that if the Commission allows frequency-hopping devices to hop among fewer than 50 channels, a power reduction is required in order to compensate for the increased potential for interference. Few commenters, however, responded to the Commission's request for comment on whether a linear reduction in power is sufficient.^{7/} TIA was the only party that performed engineering studies on this issue.^{8/}

^{5/} See WMC Comments, Attachment 1; GEC Plessey Comments at 3-4.

^{6/} See Cylink Comments at 6, 8; Part 15 Coalition Comments at 3.

^{7/} See NPRM ¶ 33.

^{8/} See Attachment to TIA Comments.

7. While Metricom is in complete agreement with TIA's methodology and results, Metricom disagrees with TIA's recommendation that a specific rule provision be adopted using that methodology. It is interesting to note that for systems operating with 25 channels, the TIA formula arrives at the same figure of 250 mW output power as proposed by Metricom. However, there is no reason to prescribe an elaborate sliding scale as TIA has. The benefits of operating a frequency-hopping system with fewer than 50 channels are only realized by reducing all the way to 25 channels. This is because LMS systems operating in the 902-928 MHz band leave only 12 MHz where they are not operating; a system using more than 25 channels cannot avoid the LMS frequencies without an unacceptable decrease in channel bandwidth from the maximum allowed bandwidth of 500 kHz. Because of the "all-or-nothing" nature of the SpectraLink proposal to use fewer than 50 channels, a similar all-or-nothing power reduction should be applied.

8. While TIA's proposal provides a reasonable measure by which to calculate permissible power, Metricom submits that a complex technical rule is not required. Section 15.247 of the rules provides the simplicity and flexibility necessary to allow creative approaches for equipment operations and development. It is not necessary to intrude upon that simplicity and flexibility through a detailed technical rule. Accepting TIA's conclusion that the relationship between the number of channels and the output power is quadratic, Metricom again submits that the Commission should simply require a fourfold reduction in power, to 250 mW, for frequency-hopping systems operating on fewer than 50 channels.

III. THE COMMISSION SHOULD REJECT THE PROPOSAL TO REQUIRE FREQUENCY-HOPPING DEVICES OPERATING ON FEWER THAN 50 CHANNELS TO AVOID THE USE OF LMS FREQUENCIES.

9. A limited number of commenters suggested that the Commission require frequency-hopping devices operating on fewer than 50 channels to avoid the LMS frequencies.^{9/} This issue has already been decided by the Commission and the proposal should be rejected.

10. The SpectraLink proposal was motivated by Part 15 users' desire to *avoid* the LMS frequencies. In the NPRM, the Commission recognized this fact by stating that: "The modification sought by SpectraLink would appear to promote frequency sharing within this band."^{10/} The proposal to prohibit Part 15 systems using less than 50 hopping channels from operating in the LMS bands appears to be based on some misplaced LMS notion that Part 15 operators have the specific intent to disrupt LMS operations.

11. The battle between the Part 15 operators and the LMS operators over the use of the 915 MHz band has already been fought and decided in the LMS proceeding. The Commission mandated that Part 15 and LMS were to share the 915 MHz frequency band. As stated in Metricom's Comments, that decision has been made, and is not appropriate for reconsideration in this proceeding.^{11/}

12. Furthermore, if there is a potential for interference to LMS systems from frequency hopping spread spectrum operations utilizing less than 50 hopping channels, then

^{9/} See, e.g., Ericsson Comments at 3; Teletrac Comments at 4-6.

^{10/} NPRM ¶ 30.

^{11/} See Metricom Comments at ¶¶ 14-16.

the Commission should adopt Metricom's proposal to limit such systems to 250 mW power. This power level will significantly lessen the potential for interference to LMS systems.

IV. THE COMMISSION SHOULD CLARIFY THAT THE PROHIBITION ON HOPPING SEQUENCE COORDINATION APPLIES ONLY TO INTRASYSTEM COORDINATION, AND DOES NOT RESTRICT A TRANSMITTER'S ABILITY TO AVOID OCCUPIED CHANNELS.

13. Several commenters request that the Commission relax the "no-coordination" rule and permit frequency-hopping systems to adapt to their external environments.^{12/} Metricom respectfully suggests that these requests are founded upon a misunderstanding of the scope of the prohibition on coordination. That prohibition, which as the Commission notes is stipulated in the grant of certification it issues to each frequency-hopping spread spectrum system under note 47, prohibits coordination between transmitters operating as part of the same system for the purpose of avoiding interference among transmitters within the same system.

14. It would be a nonsensical reading of this rule to construe it as prohibiting frequency-hopping transmitters from avoiding the use of frequencies that are already in use by other systems. There can be no public policy served by requiring a Part 15 transmitter to transmit on occupied frequencies, and thereby simultaneously interfere with the incumbent signal and reduce its own throughput.

^{12/} See, e.g., Apple Comments at 5-6; Digital Wireless Comments at 1.

V. THE COMMISSION MAY PERMIT DEVICES EMPLOYING SHORT-DURATION TRANSMISSIONS SO LONG AS THOSE DEVICES COMPLY WITH THE PART 15 RULES

15. As Metricom stated in its initial comments, there is no reason to preclude short duration transmission systems from authorized operation as frequency-hopping systems under Section 15.247, as long as those systems comply with the provisions of that rule. One apparent misunderstanding concerning the application of the rule must be clarified. ITRON's request that "there be no minimum requirement on the number of frequency hops during any one transmission sequence"^{13/} appears to be based on a misinterpretation of the hopping requirements. Section 15.247 does not impose a minimum hopping requirement.

16. The hopping requirement of the rule does not, as ITRON suggests, mandate that each time a transmission is commenced, the transmitter must stay on the air until it hops through a minimum of 50 channels. Such a requirement would be extremely spectrally inefficient because it would require transmissions not for the sake of transmitting data, but merely for the purpose of transmitting an RF signal. Certainly, the Commission could not desire this objective. The rule only requires that any time a necessary RF transmission is terminated, the *next* transmission must be on a pseudorandomly chosen frequency and, over a large sampling time relative to the channel occupancy time, the transmissions must hop through a minimum of 50 channels in the aggregate, not each time there is a transmission burst session.

^{13/} See ITRON comments at 5.

VI. THE COMMISSION SHOULD REJECT PROPOSALS TO REQUIRE INTERFERENCE IMMUNITY DESIGN STANDARDS

17. Several commenters requested that the Commission impose interference immunity design standards upon Part 15 spread-spectrum devices to avoid interference from ISM devices operating in the same frequency bands.^{14/} Metricom submits that such standards are unnecessary.

18. When the Commission issued its order creating a new service, LMS, authorized to operate in the 902-928 MHz band, it also provided some safe harbors for Part 15 operations. Within these safe harbors, Part 15 systems were presumed not to cause harmful interference to LMS operations.^{15/} Part 15 operation received no interference protection from LMS or any other service, and it maintained its status at the bottom of the hierarchy.

19. The design of spread spectrum systems inherently incorporates interference immunity. These systems are designed to function efficiently in the current environment of ISM devices. Based upon current allocations additional standards would be redundant and unnecessary, and would place a constraint on the technical flexibility needed for the continuing development of high performance spread spectrum technologies.

^{14/} See IMPI Comments at 2; Fusion Comments at 5.

^{15/} See § 90.361.

VII. THE COMMISSION SHOULD ADOPT THE IEEE STANDARD FOR RF EXPOSURE

20. Metricom agrees with the commenters who support the adoption of the ANSI/IEEE C95.1-1992 Standard for exposure to RF radiation for use with high-gain antennas.^{16/} Metricom believes that, coupled with a limitation on purchase and installation of high-gain antennas by members of the general public, exposure to RF radiation can be controlled through the use of warning signs posted in areas of fixed, high-gain antenna locations.

VIII. CONCLUSION

WHEREFORE, the premises considered, Metricom urges the Commission to adopt the proposals contained in the NPRM in accordance with the views expressed in Metricom's Comments and Reply Comments.

Respectfully submitted,

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^{16/} See Apple Comments at 8; Cylink Comments at 10; Part 15 Coalition Comments at 5.